

# SL 18

## **SYNTHESIS OF WATERBORNE POLYMER/CLAY NANOCOMPOSITES BY MINIEMULSION POLYMERIZATION USING CATIONIC REACTIVE OLIGOMERS**

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Polymer/clay nanocomposites exhibit often outstanding mechanical, thermal, barrier and flammability properties [1-3] that have made them very attractive for the development of a new class of materials; the so-called nanocomposites. The enhanced properties of the nanocomposite materials, as compared with conventional materials, comes from the small size of the clays and the high aspect ratio of the clay platelets that upon exfoliation might render polymeric materials with enormous surface interaction area between the polymer and the clay. In order to synthesize such materials it is therefore necessary to homogeneously disperse the clay mineral in the host polymer matrix (compatibility between polymer and clay is a key parameter) and furthermore to delaminate (exfoliate) the clay platelets, which due to the electrostatic interactions are naturally forming stacks. In order to produce waterborne polymer-clay nanocomposites with exfoliated nanostructures several routes might be employed. Both emulsion and miniemulsion polymerizations have been used to produce polymer-clay nanocomposite latexes with clay contents between 3-5wt% [4-6].

In this work miniemulsion polymerization was used to produce polymer/clay nanocomposites.

For this purpose, clay minerals were modified to render them hydrophobic enough and hence increase the compatibility with the monomer/polymer mixture and improve their dispersion in the polymer particles. The organic cations used to modify pristine sodium montmorillonite (Na-MMT) were synthesized by nitroxide mediated controlled radical polymerization and hence were living species that could initiate polymerization within the interlayer space of the Na-MMT platelets. Two different organic cationic species were synthesized. An oligomer of MMA/Styrene synthesized by means of aqueous phase polymerization in the presence of AIBA (a cationic initiator) and SG1 nitroxide. The second oligomer was prepared in two stages: first a copolymer of MMA/Styrene/maleic anhydride (87.5/9.5/3 mol%) was synthesized in solution polymerization under the presence of SG1. In order to render this oligomer cationic, it was further reacted with a diamine (Jeffamine, Hunstman). The reactive species were ionically exchanged with pristine Na-MMT. XRD and TGA demonstrated incorporation of the reactive species in the clay interlayer. Miniemulsion polymerization of MMA/BA monomers in the presence of these modified clays was carried out and nanocomposite latexes with partially exfoliated structures were prepared and characterized.

### References

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